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EXAMINING THE RELATIONSHIP BETWEEN EDUCATION AND PERSONAL  
CONTROL OVER HEALTH: A MEDIATION ANALYSIS

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EXAMINING THE RELATIONSHIP BETWEEN EDUCATION AND PERSONAL  
CONTROL OVER HEALTH: A MEDIATION ANALYSIS

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## Abstract

The authoritative and dominant structural systems within the United States have made health equality challenging to achieve. The Health Belief Model suggests that health outcomes are related to individuals' beliefs regarding their perceptions of health, with an imperative perception being the sense of control over health someone has. I use Human Capital Theory as a guiding framework to explain how education relates to a person's sense of control over their health. Educational attainment is a leading factor in producing a higher sense of control. This relationship between educational attainment and sense of control may be mediated by factors produced indirectly by educational attainment, such as access to quality healthcare, and factors that may change the sense of control someone has, such as days missed from work/daily activities due to health-related issues. For this research, I use data from the Midlife in the United States (MIDUS) Refresher (2011-2014). Using OLS regression models and the product of the coefficients approach, I find that access to quality healthcare mediates the relationship between educational attainment and a sense of control over health. In addition to this, days missed from work/daily activities only mediates this same relationship for those with a bachelor's degree. Suggestions for policy and practice are discussed in light of these findings.

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## INTRODUCTION

There is an array of research dedicated to the inequalities within the healthcare system. In order to properly examine the inner workings of the relationship between educational attainment and a sense of control over health, there must be a focus on the larger structural frameworks that have contributed to it. Large structural frameworks in the United States have perpetuated inequalities amongst groups of people through racial discrimination and stratification, which has produced inequities in health outcomes and access to healthcare systems (Yearby 2018, Wasserman et al. 2019, and Matzl and Hansen 2014). Two prime influences that perpetuate adverse health effects of inequality are structural racism and differences in socioeconomic status (SES). Understanding how these structural systems affect health inequalities demonstrates the connections between individual-level inequities within health and provides a context for understanding how the current research fits this framework.

Educational attainment can affect many aspects of an individual's life, including their sense of control. It is critical to analyze the sense of control people feel over their health as it can impact their actions in receiving medical care and following the medical instructions given to them. Along with this, it can have adverse effects on health, generally, when people do not feel in control (Yearby 2018, Smith et al. 2009, Mirowsky and Ross 2005, and Bolam et al. 2003). An initial understanding of the effects of educational attainment on the sense of control over health allows for further examinations of factors that might influence the sense of control over health.

The current study focuses on the sense of control over health, how that influences health outcomes, and what previous research has found. Here I provide a detailed background on educational effects on the outcomes of sense of control over health, as well as the effect

of education on health and how certain circumstances relating to education and control over health – namely, access to quality healthcare and missing days of work/daily activities – affects health outcomes. More specifically, this study contributes to the larger issue of health inequality by analyzing if the relationship between educational attainment and a sense of control over health can be mediated through access to quality healthcare and missing days of work/daily activities because of health issues, both of which are affected by educational attainment. I apply the Health Belief Model (HBM) framework to this research as it connects self-efficacy with health behaviors while also highlighting structural elements, such as education, as a barrier to receiving better health outcomes. Within the HBM framework, I use human capital theory to explain the relationships under review. Furthermore, the integration of human capital theory fits into the HBM by accounting for the individual development of a stronger sense of personal control over their health through education.

### **The Health Belief Model**

The HBM is a popular conceptual framework formulated in the early 1950's and explains the changes and maintenance of health-related behaviors (Glanz et al. 2015). HBM's key concepts of susceptibility, seriousness, benefits, and barriers to a behavior, cues to action, and self-efficacy are used to predict why people will prevent, screen for, or control health issues (Glanz et al. 2015). The HBM initially focused on two aspects of a person's depictions of health and health behavior: threat perception and behavioral evaluation (Conner 2015). *Threat perceptions* are formed of two core beliefs: the perceived susceptibility to illness or health problems and the anticipated severity of the consequences of illnesses. Like threat perceptions, *behavioral evaluation* is also formed of two core beliefs: those concerning the benefits or efficacy of a recommended health behavior and those concerning the costs of, or barriers to,



enacting the behavior (Conner 2015). However, since its conception, the HBM has expanded to include additional components, including the *locus of control*, otherwise known as self-efficacy (Conner 2015). Both of the original aspects are important to acknowledge before self-efficacy, as they are vital components that factor into the formation of self-efficacy. It is also critical to recognize these other aspects to acknowledge that while self-efficacy is essential within the healthcare system, other aspects, such as threat perception and behavioral evaluation, also play critical roles in the healthcare system.

### **Human Capital Theory**

Human capital theory implies that education improves health because it increases effective agency (Mirowsky and Ross 1998). Specifically, the theory infers that educational attainment helps develop habits, skills, abilities, and resources to achieve a better life (Mirowsky and Ross 1998). Along with this, higher educational attainment builds human capital – the “productive capacity developed, embodied, and stock in human beings themselves” (Mirowsky and Ross 2005 p.33) by increasing effective agency, building the skills and habits necessary to navigate through life obstacles and achieving career goals, as well as creating access to resources for advancement. Research suggests that formal schooling increases skill levels, which increase effective agency (i.e., personal control; Mirowsky and Ross 2005).

Human capital theory is most commonly used in explaining economic propensity through education. However, within the current study, I apply this theory to explain how acquiring higher educational attainment builds capital, affecting their relationship to health and sense of control over health. I do this under the guise of HBM because it indicates that a sense of control is an essential aspect of receiving healthcare. Human capital theory suggests that the relationships between education and health may exist as follows: (1) education enables people to merge

health-producing behaviors into a coherent lifestyle, (2) a sense of control gained from education encourages a healthy lifestyle, and (3) educated parents encourage a healthy lifestyle in their children (Mirowsky and Ross 1998). In sum, these three hypotheses link human capital via educational attainment to a greater sense of control and health. This is because education encourages effective agency and problem-solving skills that emerge as both valuable and effective for the job market and the quality of life, generally. Using this theory, I examine the effects of mediating factors on the relationship between educational attainment and a sense of control over health. The theoretical framework of human capital also drives the current research hypotheses discussed in the following section.

Lastly, while numerous studies focus on the connection between health and education, Eide and Showalter (2011) suggest a path that incorporates human capital theory in evaluating the effect of education on labor market outcomes. Although the current research does not explicitly analyze labor market outcomes, I argue that both mediating factors of access to quality healthcare and missed days of work/daily activities due to health are indirectly related to the labor market.

### **Sense of Control Over Health**

Sense of control over health is an essential factor to health as it has been linked with better physical and psychological health outcomes (Lachman and Weaver 1998, Black et al. 2008). The idea that a sense of control over health has power over health outcomes was first introduced over 40 years ago, where Seeman and Evans (1962) stated that those with low control over their health would seek out more medical information in hopes of gaining control (Seeman and Seeman 1983). Along with this, the sense of control individuals have over their health has become a vital component of the psychosocial explanations of inequalities in healthcare (Bolam

et al. 2003). Specific demographics such as socioeconomic status, gender, and ethnicity are prominent factors that cause differences in health inequality (Bolam et al. 2003, Matzl and Hansen 2014). Bolam et al. (2003) argue that health is also shaped by an individual's comparative standing within social formations, that is obtained through educational attainment, which means those in greater positions of privilege have better access to healthcare.

Seeman and Seeman (1983) suggest that the sense of control over health is based on their health and health activities. Evidence from Seeman and Seeman (1983) suggests that a sense of control is associated with practicing preventative healthcare, being more optimistic about early medical treatment for cancer, having higher self-rated health, and showing less dependence on the use of a physician (Seeman and Seeman 1983). While this evidence is promising, the argument that a stronger sense of control over health has a causal relationship with good health cannot be made (Seeman and Seeman 1983). This is because an individual's sense of control can be a product of their own health experiences and a determinant.

Sense of control over health has been proposed as one of the main reasons for the persistence of healthcare inequalities despite the improvements in health within Western societies (Bolam et al. 2003). Sense of control over health has been argued to affect health in direct ways, such as through psychophysiological pathways with stress and indirectly through its impact on health-related behaviors (Bolam et al. 2003). Bolam et al. (2003) found that when participants discussed their control over health in a fatalistic manner, it was proposed in relation to the causes of illness, where participants felt that illness was an inevitable part of life; thus, they lacked any form of control (Bolam et al. 2003). This finding is similar to other findings when examining low-SES individuals, as they are more “readily accepting of bodily decline”

(Bolam et al. 2003, p. 21). While this account is within an individualistic manner, it can be viewed as a societal problem of structural inequalities (Bolam et al. 2003).

While personal autonomy and social factors gained through educational attainment are essential within this research, it is also paramount to discuss how medical professionals affect individuals' sense of control over their health. Skuladottir and Halldorsdottir (2008) argue that interactions with medical professionals can moderate the sense of control. The quality of encounters with health professionals can either be empowering, leading to a sense of control being maintained, which they call “remoralization”, or the encounter can be disempowering, thus leading the individual to lose a sense of control, which they call “demoralization” (Skuladottir and Halldorsdottir 2008).

### **Education and Sense of Control Over Health**

Education affects health-related outcomes in many areas, including the person's behaviors and beliefs of control over health and physiological aspects (Mirowsky and Ross 2005). Education helps individuals develop abilities that directly influence whether they feel a sense of control over their lives (Mirowsky and Ross 2005), which then encourages and enables them to live a healthy lifestyle (Mirowsky and Ross 2005). Specifically, health literacy – which is associated with educational attainment (Angner et al. 2010) – aids individuals in being proactive and involved in the decisions about their health (Smith et al. 2009). Other research has also found that education is associated with greater personal control over mobility, personal autonomy, emotions, and finances (Shieman and Pickert 2008, Lachman and Weaver 1998). This suggests that there are greater opportunities for advantages in society that come with higher educational attainment (Mirowsky and Ross 2005, Lachman and Weaver 1998), including within

the healthcare system (Angner et al. 2010). Those without adequate health literacy skills may be more susceptible to losing their sense of control within the context of healthcare.

In a qualitative study using in-depth and semi-structured interviews, Smith et al. (2009) found that those with higher education felt a much higher sense of control. Specifically, they found that those with higher educational attainment felt they were sharing the responsibility with their doctor by verifying information and exploring options further than the ones already discussed. However, those with lower educational attainment perceived their only options in decision making to be consenting to medical advice.

Research has also found that low-SES individuals, with less formal education are more likely to believe in the role of fate or powerful others, such as a god, and are less likely to believe in their self-efficacy (Lachman and Weaver 1998). Therefore, those with lower educational attainment in lower economic standing typically have fewer opportunities to influence the events in their lives than those at higher economic levels. However, educational attainment may counter the fatalistic perspective on health associated with lower-SES individuals by providing them with valuable skills, such as health literacy, to promote positive health outcomes (Mirowsky and Ross 2005). Sense of control over health has also been found to moderate the relationship between social class and health outcomes (Lachman and Weaver 1998), which again indicates that education and sense of control over health are likely related. While research has provided consistent results that higher education levels coincide with greater health, the reasoning behind these findings has not been fully established (Ross and Wu 1995). This study seeks to address this gap by examining the mediating mechanisms connecting educational attainment to a sense of control over health.

In sum, educational attainment provides the human capital to enter career paths with higher wages, paid sick leave, and employer-provided healthcare (Mirowsky and Ross 2005, Lachman and Weaver 1998, and Mirowsky and Ross 1998). With lower educational attainment, individuals are forced to work in lower-wage job sectors and are often paid hourly, which directly diminishes their earnings from the days missed from work (Yearby 2018, Rigel Hines 2020, and Stephens 2019). Likewise, those with lower educational attainment who must stop their daily activities due to health issues, such as caretaking for their families, leisurely activities, and household care, do not have the advantages to hire help in the same way someone with greater educational attainment may do. With this in mind, the adverse effects of lower educational attainment create health care inequalities that further affect the sense of control over health.

### **Health Inequality in the United States**

Structural racism – when existing systems and policies create and/or reinforce discriminatory attitudes towards minority racial/ethnic groups – and low socioeconomic status contribute to further health inequalities. For example, studies have shown that racial stereotyping, biases, and stigma within the healthcare system and beyond contribute to health inequities (Wasserman et al. 2019, Nelson et al. 2002). Considering this, the impact of structural racism has continued to reproduce wealth inequalities over the last 30 years (Yearby 2018). This is especially troubling as wealth disparities have also been attributed to disparities in an individual's sense of control (Matzl and Hansen 2014). Low-income individuals, along with racial and ethnic minorities, also face other health obstacles, including additional stressors, living in areas without areas for exercise, and higher likelihoods of exposure to environmental hazards, which all negatively impact health (Swope and Hernandez 2019, Yearby 2018, and Matzl and

Hansen 2014). Equally important, background factors such as race and economic status influence educational attainment and the quality of education, which leads to inequalities in education for minority groups and low-income groups (Eng 2016). As a result of inequities, the reductions in the number of hospitals in low-income areas have removed residents' abilities to access healthcare, led to lower quality of care in remaining hospitals due to understaffed emergency rooms, and created lower standards of care in the remaining hospitals (Yearby 2018). As such, there are apparent inequities in terms of access to quality healthcare – which may ultimately affect a person's sense of control over health – along the lines of race, class, and educational attainment.

### **The Effect of Education on Health**

Stratification is a by-product of educational inequalities based on race/ethnicity and results from policy and practices in other institutions. These inequalities within the educational system profoundly affect health (Swope and Hernandez 2019, Angner et al. 2010). Numerous studies across multiple disciplines have found an association between higher educational attainment and improved health (Hamad et al. 2018, Eide and Showalter, 2011 and Braveman et al. 2011). In a review of 89 heterogeneous studies examining health and education, Hamad and colleagues (2018) found that most studies found positive effects on numerous health outcomes through educational attainment. To mention a few, studies have suggested that higher educational attainment leads to improvements in cognition and mental health, increased access to healthcare, improvements in nutrition, lower obesity rates, and increased healthcare utilization (Hamad et al. 2018, Ploubidis et al. 2014). Research has also suggested that higher educational attainment reduces the prevalence of hypertension, mortality, smoking, and obesity (Hamad et al.

2018). These findings also recognize the association between education and higher income that is linked to improving health outcomes.

The effects of education continue to grow in terms of influence and importance throughout the life course (Mirowsky and Ross 2005), suggesting that education is a critical determinant of health in that it helps to build skills and abilities that can be used to achieve better health outcomes. In addition to this, the differences in health outcomes between individuals with various levels of educational attainment demonstrate the long-term effects of education on health (Mirowsky and Ross 2005). Educational attainment is commonly used as an indicator for the quality of life and life trajectories, such as marriage, promotions, and major purchases by an individual (i.e., a home, car, life insurance, retirement fund, and vacations; Angner et al. 2010). With this, health literacy gained through education is associated with a plethora of positive health and socioeconomic outcomes, such as quality of life, the improved likelihood of employment, greater self-reported health status, less hospitalization, and lower mortality (Angner et al. 2010, Baker et al. 1998, and Kutner et al. 2007).

### **Access to Quality Healthcare**

Those with lower educational attainment are disadvantaged in healthcare access (Yearby 2018, Rigel Hines 2020, Eng 2016). Healthcare in the U.S. is based on the ability of patients to pay for medical services. As a result of stratification due to inequities in the U.S., minority groups with low educational attainment are limited in their ability to obtain health insurance. This is in part due to the constraints placed on retaining employment that provides health insurance, or employment that provides enough income to separately purchase insurance, which they cannot access because of lower educational attainment (Yearby 2018, Rigel Hines 2020). Research has also found that individuals with low-wage jobs find obtaining insurance a difficult



task and can often not afford health insurance without assistance (Stephen 2019). Lastly, current labor trends show that less formally educated workers, predominately in lower-wage job sectors are less likely to move up to managerial positions. With this, they are also more likely to hold two or more jobs at a time (Rigel Hines 2020).

The Patient Protection and Affordable Care Act – now known as the Affordable Care Act (ACA) – was created to help increase access to healthcare and lessen the burden of high-cost health insurance (Stephen 2019). One of the main goals of the ACA was to expand access to healthcare through an enlargement of public health coverage and enhanced availability and affordability of private insurance (Stephen 2019, Wasserman et al. 2019). The ACA focused primarily on populations most vulnerable to being uninsured, which included young adults, lower-income families, and those with pre-existing health conditions (Stephen 2019). Without the burden of high costs associated with health visits, these populations can actively seek healthcare, which lessens the likelihood of an individual using emergency rooms as a replacement and prevents individuals from putting off needed medical attention (Stephen 2019). However, regarding the effectiveness of the ACA, Stephen (2019) referred to it as an “imperfect success” that has still left many lower-income families without health coverage.

### **Missing Work/Daily Activities**

The ability to take time off from work and pause daily activities due to health issues is critical to both the individual and their family (Earle and Heyyman 2006). With this, the majority of individuals in low-wage job sectors, that do not have the ability to take days off from work predominantly have lower educational attainment (Anger et al. 2010). Research by Vahtera et al. (1999) finds that the workplace environment affects health and leaves of absences from work due to health issues. Similarly, studies have found connections between missing days of work due to

illness and lower job security, where lower job security forced workers to work regardless of their health (Laaksonen et al. 2010, Niedhammer et al. 2008, and Melchior et al. 2005). A major deciding factor on whether to take a sick day is the worry of lost income (Andersen 2010). Furthermore, studies have found that sick leave is costly to the individual in immediate terms and long-lasting terms (de Buck et al. 2006, Merkesdal et al. 2005, Stark et al. 2006). Another fear that motivates low-wage workers not to miss work is termination, as with absence, individuals can lose their human capital within the workplace (Anderson 2010). These fears and job placements are a cause of low educational attainment that has decreased what little human capital the individuals currently have. Thus, missing days of work becomes an even bigger issue for those with lower educational attainment compared to those with higher educational attainment. This is because those with higher educational attainment have higher human capital and are more commonly employed in higher wage job sectors with more job security that do not enforce as strict consequences for missing work (Laaksonen et al. 2010, Mirowsky and Ross 2005, Anderson 2010, Angner et al. 2010).

Along with missing work due to health, individuals miss out on daily activities. These activities can range from household chores, family commitments, and leisure activities, all of which can negatively impact their general lifestyle and sense of control. Lower educated mothers, in particular, have been found to save up any sick days they have to take care of their child if their child becomes sick (Houser and White 2015). Furthermore, the fear or inability to miss work/daily activities due to health issues is a by-product of lower formal educational attainment, which causes individuals to work low-wage jobs, have greater job insecurity, a lower sense of control, and higher negative consequences if they do miss work/daily activities (Laaksonen et al. 2010, Mirowsky and Ross 2005, Anderson 2010, Angner et al. 2010). Because

of these effects, it is critical to evaluate how missing days of work/daily activities mediates the relationship between educational attainment and a sense of control over health.

### **The Current Study**

In this paper, I analyze (1) the relationship between educational attainment and control over health and (2) the potential mediating factors of the relationship between educational attainment and sense of control over health. Moreover, in this study, I examine whether access to quality healthcare and missed days from work/daily activities due to health-related issues mediate the relationship between educational attainment and a sense of control over health.

The current study asks three distinct research questions relating to educational attainment and a sense of control over health. The first question asks, how does educational attainment affect the sense of control over health? Due to previous literature finding a positive relationship between education and sense of control and human capital theory's suggestion that more educational attainment increases their sense of control over their health by promoting healthier lifestyles, I hypothesize a positive relationship between educational attainment and sense of control over health.

***H<sub>1</sub>:** People with higher educational attainment will feel the highest sense of control over their health.*

The second question I ask is: Does access to quality healthcare mediate the relationship between educational attainment and a sense of control over health? This question more specifically asks whether quality healthcare access directly influences the indirect relationship between educational attainment and a sense of control over health. Human capital theory implies that those with higher educational attainment receive greater benefits in the professional world, including higher earnings, job positions with health insurance benefits, and educational gains on

navigating the healthcare system. Further, previous literature has found that educational attainment relates to employment, health factors, and a sense of control. As such, access to quality healthcare allows individuals to seek healthcare when needed, increasing a sense of control over health.

***H<sub>2</sub>:** Access to quality healthcare will fully mediate the relationship between educational attainment and a sense of control over health, where those with greater educational attainment will have greater access to quality healthcare that will then create a higher sense of control over health.*

Lastly, question three asks: Does missing days of work and daily activities due to health issues mediate the relationship between educational attainment and a sense of control over health? The question, more specifically, asks whether missing days of work/daily activities due to health issues directly affect the indirect relationship between educational attainment and a sense of control. Literature findings support that those with lower educational attainment are more commonly employed in hourly-wage job sectors without benefits, such as paid time off for sick leave or higher job security, leading to a lower sense of control. As such, the consequences of missing work/daily activities are more likely to have negative consequences for those with lower educational attainment, which will lower their sense of control over health.

***H<sub>3</sub>:** Missing days of work/daily activities due to health issues will partially mediate the relationship between educational attainment and a sense of control over health for those with lower educational attainment. That is, those with less educational attainment will be less likely to miss days of work/daily activities, which will decrease their sense of control over health.*

## Data

The current study employs cross-sectional data from the Midlife in the United States (MIDUS) Refresher (2011-2014), which collected data from 3,588 respondents. The MIDUS Refresher utilizes probability sampling to collect data from Americans aged 23-76. This data has been collected through 30-minute phone interviews combined with two follow-up mail-in surveys. Information gathered through this data set includes demographic characteristics, mental and physical health information, and psychosocial data. For reference, the MIDUS refresher uses the same methods as the original MIDUS data set, including questions about the aftermath of the 2008 economic recession.

### Dependent Variables

The primary dependent variable is *control over health (Models 1-3)*. Respondents were asked on a scale of 0 to 10 how much control they perceive to have over their health (where 10 represents the most control). This is a continuous variable where the average sense of control individuals feel within the sample is 7.77, suggesting that the respondents, on average, felt some sense of control over their health.

### Independent Variables

#### *Primary*

Educational attainment is the primary independent variable. The variable *education* has been condensed into four categories: (1) *high school or less* (coded 1, 19.85%), which is condensed from the categories of no school, junior high school, high school without completion, GED, and High school, (2) *some college/vocational degree* (coded 2, 31.84%) from the categories of 1-2 years without completion of higher education, three or more years of higher education without completion, and the category of completion of a two-year vocational school,

(3) *bachelor's degree* (coded 3, 24.17%) and (4) *advanced degree* (coded 4, 24.13%) condensed from the categories of some graduate school, master's degree, and Ph.D. This variable is condensed due to multiple original categories such as “no school/only grade school and GED”, among others being too infrequently selected. Thus, by condensing, I have created categories with roughly equal frequencies in each category. This is better for comparisons as well as finding significant and meaningful results.

### *Mediators*

In Model 2, I focus on the direct effect of access to quality healthcare on the relationship between educational attainment and a sense of control. For this model, I use the mediating independent variable *access to quality healthcare*. This variable comes from the original MIDUS Refresher (2011-2014) data set, which asked respondents how much they agree or disagree with the following statement: “It is difficult for me to get good healthcare”. The categories range from 1 to 7, with 1 being “agree strongly” to 7 being “disagree strongly”. The average response is 5.35. Therefore, the average respondent is more likely to disagree with that statement, suggesting that it is not difficult for most respondents to get good healthcare.

The second mediating independent variable is *missed work/daily activities*. This variable stems from how many days the respondents cut back from work/daily home activities due to health issues in the past 30 days. This variable is continuous, with an average for the entire sample set being 1.26 days. Of the sample, 478 respondents reported having to cut back their time at work and daily activities; this group's average is roughly seven days.

### *Control*

The control variables within this study are race, age, sex, marital status, and income. The dichotomous variable of Non-Whites measures race. Race has been condensed into two racial

categories: White (coded 0, 89.29%) and Non-White (coded 1, 14.71%). I recoded this as there were too few respondents of varying racial/ethnic backgrounds, leading to minimal findings within the results. Age is a continuous variable that ranges from 23 to 76 years of age, with the average individual being almost 52. Sex is measured by the dichotomous variable Female, with Males (coded 0, 49.17%) and Females (coded 1, 50.83%). Marital status is measured by the dichotomous variable of Married, which has been condensed to Not Married (coded 0, 34.9%) and Married (coded 1, 65.1%). Lastly, the original data set created categories for income based on each time a respondent answered the question of their total household income before taxes the previous year. This created over 250 categories of income, which I then condensed into five categories following income brackets similar to those seen in the U.S. Census data. These categories are \$20,000 or less (24.22%), \$21,000-40,000 (24.17%), \$41,000-60,000 (19.42%), \$61,000-80,000 (13.4%), and \$82,000 or more (18.79%). For a more comprehensive view of the data, see Table 1 for the descriptive statistics.

Table 1. Descriptive Statistics

<b>Variable</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Min</b>	<b>Max</b>
<b>Control Over Health</b>	7.77	1.889	0	10
<b>Education</b>				
Highschool or Less	0.199	0.399	0	1
Some College	0.318	0.466	0	1
Bachelor's Degree	0.242	0.428	0	1
Advanced Degree	0.241	0.428	0	1
<b>Difficult to Get Good Medical Care</b>	5.346	1.892	1	7
<b>Missed days of work/daily activities</b>	1.263	3.993	0	30
<b>Race</b>				
Non-White	0.147	0.354	0	1
<b>Age</b>	51.84	14.267	23	76
<b>Sex</b>				
Female	0.508	0.500	0	1
<b>Marital Status</b>				
Married	0.651	0.477	0	1
<b>Income</b>				
\$20,000 or less	0.242	0.429	0	1
\$21,000-\$40,000	0.242	0.428	0	1
\$41,000-\$60,000	0.194	0.396	0	1
\$61,000-\$80,000	0.134	0.341	0	1
\$82,000 or more	0.188	0.391	0	1

N=2,060, Source: Midlife in the United States Refresher (2011-2014)

## Analytical Strategy

### Mediation

Both Models 2 and 3 use mediation analysis. Research in the earliest stages primarily focuses on establishing the relationship between two variables, while also determining if the relationship is causal (Hayes 2013). However, as research develops, researchers then turn towards understanding and demonstrating the mechanisms by which the effect exists (Hayes 2013). Along these same lines, by studying how a relationship works deepens the understanding of the relationship, as well as gives insights into developing stronger recommendations on how the results can be applied (Hayes 2013). With this, mediation is also chosen as the analytical strategy as it shows the direction of a relationship, rather than using other approaches, such as



controlling for the mediator (Hayes 2013). Mediation analysis is used to test if the relationship between an independent variable (X) and a dependent variable (Y) is indirectly affected by a mediating variable (M). In this way, a mediating variable aids in explaining the causal relationship between the two main variables, or “how” the relationship works. Furthermore, there are two types of mediation: complete mediation and partial mediation (Baron and Kenny 1986). Complete mediation occurs when the independent variable within the model becomes insignificant and does not influence the dependent variable (Baron and Kenny 1986). Partial mediation occurs when the independent variable within the model decreases in significance but still affects the dependent variable (Baron and Kenny 1986). In Models 2 and 3, I use the mediating variables of *access to quality healthcare* and *missed days of work/daily activities* to evaluate if a third variable connects educational attainment and the sense of control over health. More specifically, I examine whether it is through access to quality healthcare (hereafter referred to as access to care) and missed days from work or leisure activities that education connects to control over health.

There are different ways to do mediation analysis, one of which is the Barron and Kenny method. This is a long-standing method for mediation analysis but has undergone criticisms such as how it does not test the significance of the indirect pathways nor examines other main areas of mediation (Mackinnon et al. 2007). This method of the causal step approach could also be described as outdated, as it has been shown to have the lowest power when testing intervening variable effects (Hayes 2009). The causal step approach does not use quantification to test for the intervening effects, which is the prime goal of mediation analysis (Hayes 2009). Because of these issues, I use a different method of mediation analysis but also use the Barron and Kenny method to run an additional analysis not displayed to confirm the results.

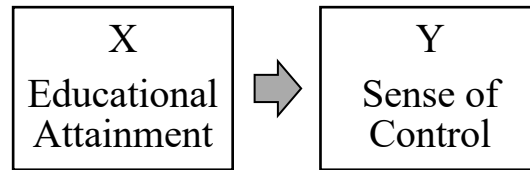
For this research, I use the product of the coefficients method. The product of coefficients method establishes the indirect effects by multiplying the regression coefficients. This involves a three-step approach that includes doing separate regressions and examining the significance of the coefficients in each regression. The first step of the three-step approach will involve Model 1 in both Models 2 and 3. The next step is an OLS regression featuring the mediator variable. In this step, I compare the significance of the independent variable from step one to its significance in step two. The change in significance will determine if there is mediation occurring. In step two, mediation results alone are not sufficient to state that mediation has fully occurred. Therefore, in step three, I find and test the mediation coefficients. To do this, I use a seemingly unrelated regression (Stata command *sureg*), with the predictor variables being *educational attainment* and the mediating variable on the outcome *of a sense of control*. All previously stated control variables are included in the models (Non-White, age, Female, married, and income).

### **Model 1**

In Model 1, I use an Ordinary Least Squares (OLS) regression to examine the relationship between educational attainment and a sense of control over health. This is testing a direct relationship between X and Y, as shown in Model 1's path diagram. I use OLS regression because the dependent variable is continuous and is the best linear unbiased estimator. I include all control variables (Non-White, age, Female, married, and income). In the OLS regression I want to have a normal distribution, as a skewed model is less accurate and can create errors (Andy 2019). Before examining the results, I tested whether the logged form of the variable *control* is closer to a linear model than the unlogged variable. I find that the logged form of *control* is not suitable and will continue with the unlogged form. After this, I also use the ladder command within Stata to test if another form of the variable *control*, such as the squared version

would create normal distribution. With this, I find that the variable *control* in its current state is statistically significant, meaning it is the best fit and that I can use the original control variable, rather than a logged, or squared version. I also test for multicollinearity using the Variation Inflation Factor (VIF) command, which gives a mean of 1.54. This is an acceptable VIF value that indicates low multicollinearity within the model. Figure 1, presented below, displays the direct relationship of education attainment on sense of control.

Figure 1. Path Diagram-Direct Relationship



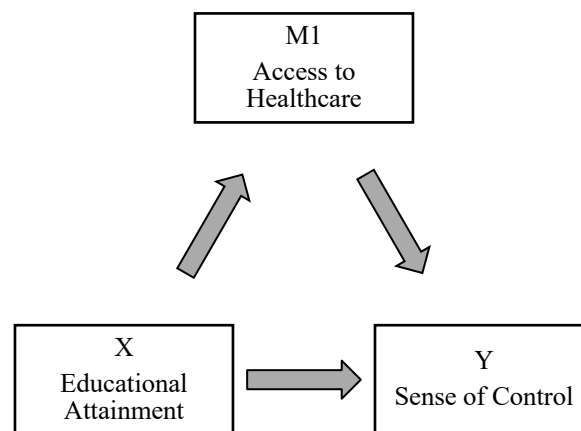
## Model 2

In Model 2, I examine whether an individual's feelings of difficulty to access quality healthcare (shortened to *access to healthcare* (M1)) mediates the relationship between *educational attainment* (X) and *sense of control over health* (Y) (see Figure 2). To do this, I use three separate regressions, as described above. The first OLS regression is already computed within Model 1; this OLS regression is used to test if there is a significant relationship between the primary independent and primary dependent variables. For this step, I use the equation  $Y = B_0 + B_1X + e$ . This is to see if  $B_1$  is significant. Within the second regression, I use an OLS regression of the predictor variable of *educational attainment* and the mediating variable of *access to quality healthcare* on the outcome of a *sense of control over health*. This is where I can examine if  $B_1X$  is now non-significant or has a lower significance than in the first equation, which alludes to mediation. The third and final step of the process is to compute the mediation coefficients. To do this, I use a seemingly unrelated regression analysis that uses two OLS

regressions; the first regression is *education* predicting the outcome of the mediator. This regression's results show if the independent variable and the mediating variable have a significant relationship. If the regression shows that they do not, then mediation cannot occur. The second regression is the same regression used in step two of the process, where both the primary independent variable (*education*) and the mediating variable predict the outcome of a *sense of control*.

The Figure 2. Path Diagram – Mediation for Model 2 displays the importance as to why I use mediation. With mediation I can focus on the pathway that causes the relationship between educational attainment and sense of control over health. With the figure, displayed below, there are only arrows pointing directly from X to Y (the direct relationship) and arrows pointing from X to M1 to Y (the mediating relationship). This is critical, as I want to examine whether educational attainment's effect on sense of control over health is actually explained through the effects of another variable (M1).

Figure 2. Path Diagram-Mediation for Model 2



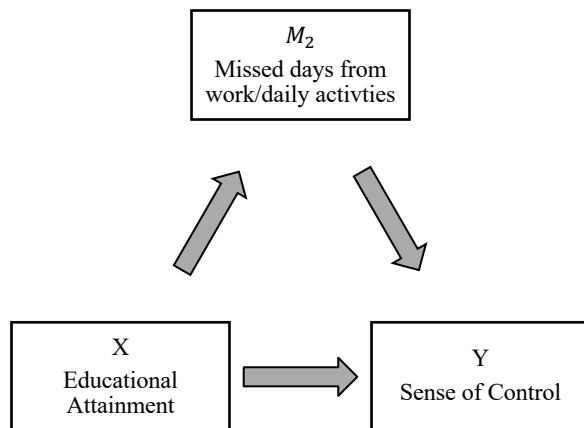
Assuming that I find mediation, whether full or partial, I then use the *bootstrap* command to compute the indirect effects. Bootstrapping is a non-parametric method that is based on resampling with replacement, which I replicate 5,000 times (Preacher and Hayes 2008). Using

the bootstrapping method is the best method, as other methods, such as using the *nlcom* (nonlinear combination) command, uses the delta method. This is problematic as the delta method assumes that the estimates are normally distributed, where, in this situation, the indirect effects are typically positively skewed, making the results from using *nlcom* untrustworthy. Furthermore, the bootstrapping method gives results that are bias-corrected, making them more reliable and accurate (Preach and Hayes 2008).

### Model 3

In Model 3, I analyze if the number of *days missed from work/daily activities* due to health issues mediates the relationship between *educational attainment* and the *sense of control over health* (see Figure 3). Within this model, I follow the same procedures laid out in Model 2 but replace the mediating variable of *access to healthcare* with *days missed from work/daily activities*. In this model, *days missed from work/daily activities* is labeled as  $M_2$ . Again, as in Model 3, the path diagram, Figure 3, is essential in explaining why I use mediation analysis.

Figure 3. Path Diagram-Mediation for Model 3



## Results

### Model 1

The results from Model 1 show that individuals with a bachelor's degree or an advanced degree are more likely to have a higher sense of control over health when compared to those with a high school education or less. Results also show that having some college/vocational degree does not affect the sense of control over health. These results align with previous literature findings that greater educational attainment has a significant and positive effect on the sense of control over health. In other words, those with a bachelor's degree have a net increase of 0.34 on their sense of control over health, while those with an advanced degree have a net increase of 0.31. See Table 2 for full results.

Table 2. Model 1 Education's Effects on Sense of Control Over Health

Variable	Sense of Control Over Health	
	$\beta$	SE
<b>Education</b>		
Some College	0.098	(0.120)
Bachelor's Degree	0.343**	(0.132)
Advanced Degree	0.306*	(0.140)
<b>Race</b>		
Non-White	0.099	(0.119)
<b>Age</b>	-0.003	(0.003)
<b>Sex</b>		
Female	0.120	(0.089)
<b>Marital Status</b>		
Married	0.244**	(0.090)
<b>Income</b>		
\$21,000-\$40,000	0.324**	(0.121)
\$41,000-\$60,000	0.476***	(0.132)
\$61,000-\$80,000	0.573***	(0.152)
\$82,000 or more	0.319*	(0.148)
Intercept	7.217***	(0.221)
<i>N</i> =2,060		

Standard errors in parentheses \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$   
Source: Midlife in the United States Refresher 2011-2014

## Model 2

The first step's mediation process results are explained above in Model 1, where it shows that those with greater educational attainment are more likely to have a greater sense of control over health. Table 3 displays the mediation process. Within the first OLS regression of *access to quality healthcare* on *educational attainment*, results show greater access to quality healthcare at all levels of education. In more detail, the results show that someone with greater educational attainment will have even more access to quality healthcare, than someone with less educational attainment. This shows a significant relationship between the independent and mediating variables, which is a prerequisite to mediation. The second OLS regression is of a *sense of control over health* on *access to quality healthcare* and *educational attainment*. Findings from this regression show that once I include the mediator *access to quality healthcare* in the model, *educational attainment* loses all significance. This result shows that full mediation occurs, while also showing that greater access to quality healthcare improves the sense of control over health. Along with this, this model finds that about 44% of the relationship between education and a sense of control over health is directly affected by access to quality healthcare. This indicates that access to quality healthcare is a key component in increasing the sense of control over health; see Table 3 below for full results.

Table 3. Model 2 Multiple Regressions of Education and Access to Quality Healthcare on Sense of Control – Full Mediation

Variable	Access to Quality Healthcare		Sense of Control Over Health	
	$\beta$	SE	$\beta$	SE
<b>Education</b>				
Some College	0.286*	(0.115)	0.038	(0.117)
Bachelor's Degree	0.621***	(0.126)	0.212	(0.130)
Advanced Degree	0.673***	(0.134)	0.164	(0.138)
<b>Access to Quality Healthcare</b>			0.210***	(0.023)
<b>Race</b>				
Non-White	-0.233*	(0.114)	0.147	(0.116)
<b>Age</b>	0.014***	(0.003)	-0.007*	(0.003)
<b>Sex</b>				
Female	0.124	(0.085)	0.094	(0.087)
<b>Marital Status</b>				
Married	0.325***	(0.086)	0.176*	(0.088)
<b>Income</b>				
\$21,000-\$40,000	0.390***	(0.116)	0.242*	(0.118)
\$41,000-\$60,000	0.746***	(0.127)	0.319*	(0.130)
\$61,000-\$80,000	1.022***	(0.145)	0.358*	(0.150)
\$82,000 or more	0.993***	(0.141)	0.111	(0.146)
Intercept	3.419***	(0.211)	6.499***	(0.229)
<i>N=2,060</i>				

Note: Standard errors in parentheses. Models are estimated simultaneously.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

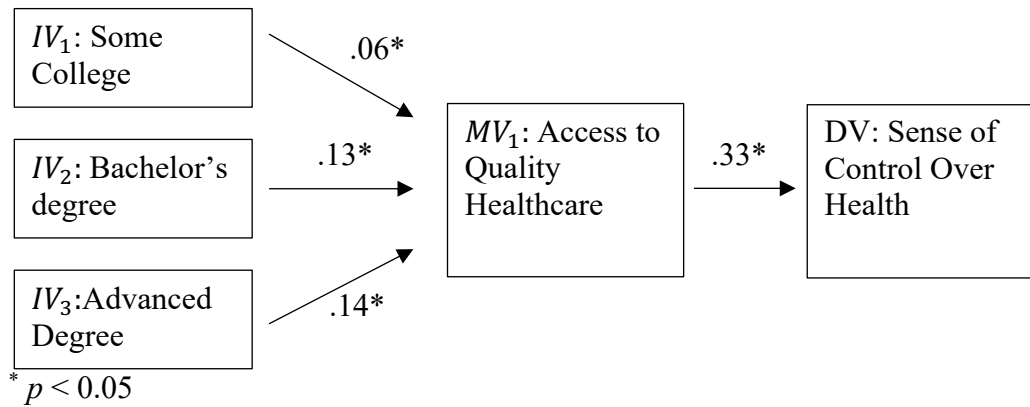
### *Indirect Effects*

I use bootstrapping to find and test the significance of the indirect effects of the independent variable on the dependent variable through the mediating variable. Figure 5, shown below, displays the indirect effects of educational attainment through access to quality healthcare on the outcome of a sense of control over health. Results show having some college/vocational degree indirectly affects the sense of control through access to quality healthcare by .06. A bachelor's degree indirectly affects the sense of control indirectly through access to quality healthcare by .13. Lastly, advanced degree's indirectly affects the sense of control over health through access to quality healthcare by .14. The bootstrap command also indicates that the total



indirect effect is .33 and significant. Furthermore, each of the indirect effects and the total indirect effect are significant when using either percentile confidence intervals at 95% or bias-corrected confidence intervals at 95% to test for significance.

Figure 5. Model 2 Mediation Analysis Indirect Effects



### Model 3

For Model 3, again, the first part of the results are in Model 1. In this step, the direct relationship between *educational attainment* and *sense of control* shows that those with greater educational attainment are more likely to have a higher sense of control over health. Table 4, shown below, displays the results of the mediation process. In the first OLS regression of *educational attainment* on the outcome of *missing work/daily activities*, results show that those with a bachelor's degree are less likely to miss days of work/daily activities. Along with this, missing days of work/daily activities does not affect those with some college or an advanced degree. Because only one category of education is related to missing days of work/daily activities, only partial mediation can be possible. The second OLS regression includes both the independent variable (*educational attainment*) and the mediating variable (*missing work/daily activities*) on the outcome of *a sense of control over health*. The results show that having a bachelor's degree has a significant effect on a *sense of control over health*, but the effect is

smaller in significance. Because of this decrease in significance, the results confirm that partial mediation occurs, but again, only for those with a bachelor's degree. This same regression also shows that missing days of work/daily activities decreases the sense of control. See Table 4 for full results.

Table 4. Model 3 Multiple Regressions of Education and Access to Quality Healthcare on Sense of Control – Partial Mediation

Variable	Missing Work/Daily Activities		Sense of Control Over Health	
	$\beta$	SE	$\beta$	SE
<b>Education</b>				
Some College	-0.414	(0.250)	0.052	(0.117)
Bachelor's Degree	-0.639*	(0.276)	0.271*	(0.128)
Advanced Degree	-0.350	(0.292)	0.267*	(0.136)
<b>Missed Days of Work/Daily Activities</b>			-0.112***	(0.010)
<b>Race</b>				
Non-White	-0.398	(0.248)	0.054	(0.115)
<b>Age</b>	0.014*	(0.006)	-0.002	(0.003)
<b>Sex</b>				
Female	0.329	(0.185)	0.157	(0.086)
<b>Marital Status</b>				
Married	-0.841***	(0.188)	0.150	(0.088)
<b>Income</b>				
\$21,000-\$40,000	-1.049***	(0.252)	0.206	(0.118)
\$41,000-\$60,000	-1.050***	(0.276)	0.358**	(0.129)
\$61,000-\$80,000	-1.278***	(0.316)	0.430**	(0.148)
\$82,000 or more	-1.262***	(0.308)	0.178	(0.144)
<b>Intercept</b>	2.200***	(0.460)	7.463***	(0.215)
<i>N</i> =2,060				

Note: Standard errors in parentheses. Models are estimated simultaneously.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

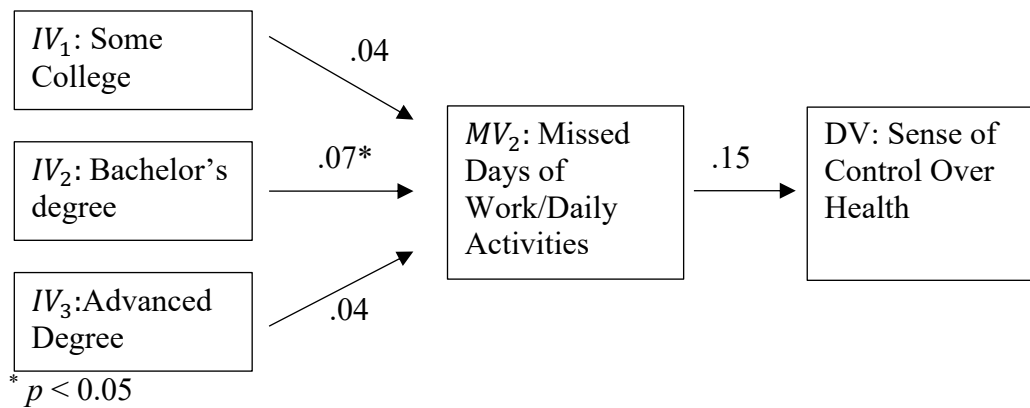
### *Indirect Effects*

The relationship between *education* and *a sense of control* is partially mediated by *missed days of work/daily activities due to health issues*, but only for those with a bachelor's degree.

Both categories of some college/vocational degree and advanced degree do not have a significant

relationship to the mediator, meaning mediation cannot occur. In addition to this, after bootstrapping, only those with a bachelor's degree have a significant indirect effect. To make this more concrete, having a bachelor's degree indirectly affects their sense of control over health through missing days of work/daily activities by .07. Furthermore, the indirect effect is significant at both percentile confidence intervals at 95% and biased-corrected intervals at 95%. Figure 6 illustrates the indirect effects of the independent variable *education* through *missed days of work/daily activities due to health* on the outcome of *a sense of control over health*.

Figure 6. Model 3 Mediation Analysis Indirect Effects



## Discussion

Prior research has found that a person's sense of control over health is positively associated with educational attainment. This study expands upon this literature by examining potential mediating mechanisms that might explain this relationship. The findings of this study make an important contribution to the study on health inequality by showcasing the critical need for access to quality healthcare, regardless of educational attainment, to achieve a greater sense of control over health. These findings also expand knowledge on the adverse effects of missing days of work and daily activities on the sense of control over health. These findings suggest a broader implication for improving health outcomes by expanding quality healthcare access in the

form of an expansion of employer-provided healthcare to include benefits for those in lower-wage job sectors, a reform of policies on paid sick days to increase paid time off, with more flexibility for those with children, and improvements in policies and practices to generate affordable avenues for more individuals to gain higher educational attainment. Furthermore, these suggestions may also help alleviate systemic race and class issues by decreasing health inequalities for low-wage workers, minorities with less access to formal education, and families who cannot afford day-sitters when their children must miss school due to health issues, or homecare when they must miss out on daily activities due to health issues. These suggestions will also benefit the doctor-patient relationship in that with more access to healthcare and higher educational attainment, individuals will feel more a part of the conversation, which will result in better healthcare treatment. Additionally, my findings are consistent with human capital theory within the HBM framework, which suggests greater educational attainment provides benefits in many areas of life.

This study explores underlying mechanisms that influence the relationship between educational attainment and a sense of control over health. I first examined the relationship between educational attainment and sense of control over health using the MIDUS Refresher (2011-2014) data to confirm that education and sense of control over health are related. The results from Model 1 supported the hypothesis that *people with higher educational attainment will feel the highest sense of control over their health*. In this study, the results show that those with a bachelor's degree or higher are significantly more likely to feel a higher sense of control over their health compared to those with a high school degree or less, holding all else equal. In addition to this, the results indicate that those with lower educational attainment, such as some college/vocational degree, do not benefit from the same positive effects on their sense of control

as do those with greater educational attainment, again supporting the first hypothesis. In sum, the benefit of having a greater sense of control over health occurs for those with at least a bachelor's degree. As previous research has demonstrated, this relationship is likely explained by greater human capital, access to resources in advancement, and the capability to effectively navigate both life as well as the healthcare system through higher educational attainment (Mirowsky and Ross 2005, Lachman and Weaver 1998, Angner et al. 2010, Shieman and Pickert 2008, and Mirowsky and Ross 1998).

The results from Model 2 reveal that the accessibility to quality healthcare fully mediates the relationship between educational attainment and the sense of control over their health. Thus, the second hypothesis - *access to quality healthcare will fully mediate the relationship between educational attainment and a sense of control over health, where those with greater educational attainment will have greater access to quality healthcare that will then create a higher sense of control over health* - is accepted. In more specific terms, Model 2 affirms that access to quality healthcare supersedes higher educational attainment's benefits on the sense of control over health. This is due to access to quality healthcare being a defining factor in increasing the sense of control over health; thus, educational attainment should be viewed simply as a pathway to grant access to quality healthcare.

These findings coincide with previous research done by Hendryx et al. (2002) in which social capital is related to improved access to healthcare. While this study focuses on human capital, it is not a far leap to state that increased educational attainment enhances social capital, as it does for human capital. Along with these findings, the results from Model 2 expand upon the idea of candidacy to access healthcare as a better method of analyzing access, as stated in research done by Dixon-Woods et al. (2006). The term candidacy is used to refer to those who

have the means and abilities to access healthcare. These means and abilities can include health insurance and a higher income, which can be obtained through higher educational attainment. In addition to this, access to healthcare can include understanding how to navigate the healthcare system (Dixon-Woods et al. 2006). Additionally, in learning to navigate the healthcare system, educational attainment can be a providing factor.

Results from Model 2 serve to bring awareness to the broader relationship between educational attainment and the sense of control over health by showing that other factors, such as access to quality healthcare, indirectly affect the sense of control over health. Because of these findings, policymakers should focus their attention on improving access to healthcare for individuals, regardless of their education, to improve their sense of control over health. This could be in the form of (1) new insurance policies, as we have seen in the past with the ACA, (2) a focus on educating individuals on how to navigate the healthcare system at a younger age, such as in high school, or (3) improving upon current policies regarding employer-provided health insurance. By implementing policies and practices that encourage and allow more individuals to access healthcare, educational attainment may become less of a determinant in feeling control over health. Model 3 supports partial mediation of missing days of work/daily activities in the relationship between educational attainment and a sense of control over health. However, results show this mediation only occurs for those with a bachelor's degree. As such, Hypothesis 3 - *Missing days of work/daily activities due to health issues will partially mediate the relationship between educational attainment and a sense of control over health for those with lower educational attainment. That is, those with less educational attainment will be less likely to miss days of work/daily activities, which will decrease their sense of control over health* - is rejected. I reject this hypothesis because the results show that those with lower educational attainment are

not indirectly affected by missing days of work/daily activities due to health issues. Unfortunately, the survey from which these data derived from did not ask for the specific reasons that the respondent missed days of work/daily activities – or why they did not miss work/daily activities even while being sick – which would make the relationship between these variables much clearer. There have been studies on the effects of depression on missing days of work and daily activities (see Broadhead 1990, Simon et al. 2000), for example, as well as the loss of productivity from the companies by employees missing work (Nicholson et al. 2006, Lerner et al. 2003), which might explain why individuals continue to work while sick.

However, in a study of 22 countries, the United States is one of three countries that do not have national policies for paid sick leave for employees needing five or more days (Heyman et al. 2010). Because of this, research has found that those without paid sick leave will not take a day off of work due to financial loss or the jeopardization of their job (DeRigne et al. 2016). These literature findings provide insight into the explanations of why low-wage workers with low job security will work while sick. In addition to this, low-wage workers can face conditions much more harmful to their health, which would suggest they need more paid sick days than someone in a better job setting. This data set has too many limitations to support or reject these explanations.

### **Future Research and Limitations**

The MIDUS Refresher (2011-2014) data allows researchers to investigate a host of topics relating to health. However, the data are limited in its low count of minorities within gender identities and race/ethnicity and, as stated previously, the data lack questions that define specific reasons as to why an individual missed work/daily activities, as well as a question asking why they chose to go into work while sick. By not having follow-up questions to these variables, it

limits the explanatory value of the findings. Furthermore, while 2011-2014 is still considered a relevant period, much has changed since then, such as the presidency of Donald Trump, the rise of the economy since the time of data collection, employment rates, and new immigration and health insurance policies, thus an updated version could have brought new insights.

In this current study, I found that access to quality healthcare fully mediates the relationship between educational attainment and a sense of control over health. In light of this, future research should focus on exploring intersectional approaches to understanding the relationship of the mediating factor *access to quality healthcare*. Now that access to quality healthcare has been established as a mediating factor between education and the sense of control over health; research can move forward into examining other pathways that may mediate this same relationship. Moreover, future research should focus on how race and ethnicity may affect access to quality healthcare and those who are part of the LGBTQ community, which would shed further light on the relationship between educational attainment and a sense of control. Finally, future research may examine how the recent pandemic affects the sense of control over health. These suggestions will bring new insights into what contributes to a greater sense of control over health, which can create a better understanding of the importance of the sense of control over health and how it can be improved through policy reforms, education, and programs.

## **Conclusion**

This study expands the working knowledge of health inequalities and how there are detrimental effects for those who are not afforded the opportunity to gain human capital to increase their sense of control over health. In doing so, this study examined whether access to quality healthcare and missing days of work/daily activities due to health issues directly affects the relationship between educational attainment and a sense of control over health. The findings



of this study demonstrate the significance of human capital to feel a greater sense of control over health, greater access to quality healthcare, greater physical health, and the adverse effects of missing days of work/daily activities. This study demonstrates the importance of access to quality healthcare and access to greater educational attainment in increasing the sense of control over health. Both factors lead to further discussion and research into exploring ways to eliminate barriers to increasing the sense of control over health. Lastly, these findings give insight into the larger issue of health inequality by exemplifying the importance of access to healthcare, access to employer-provided health insurance or lower costs for individualized health insurance, and the importance of creating more pathways to educational attainment, all in efforts to increase the sense of control.

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